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FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
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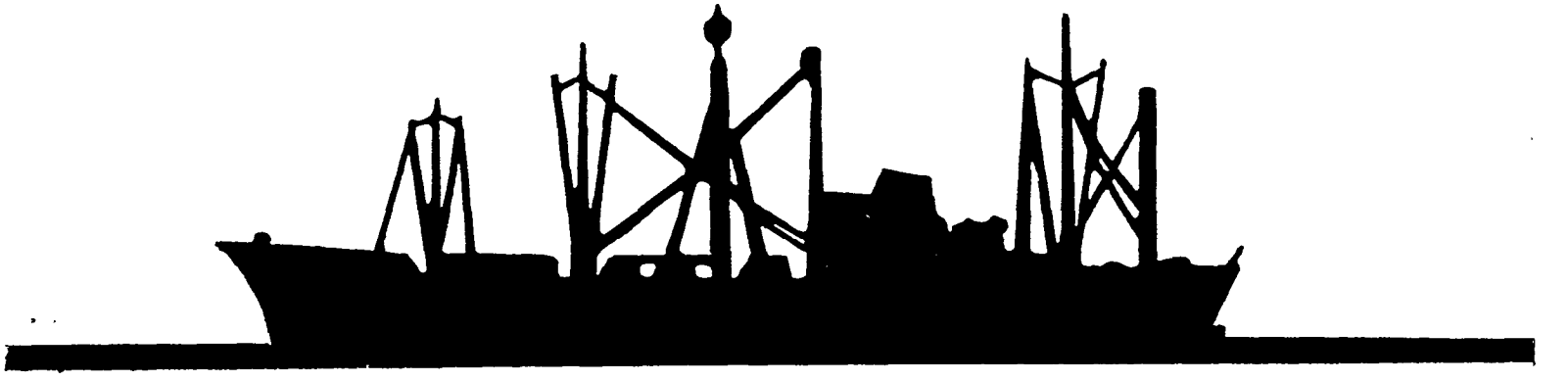
Proceedings
IREAPS Technical Symposium
September 14-16-1982
San Diego, California

VOLUME I



INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

COMPUTERVISION INTERFACE TO BATCH ELECTRIC BOAT PIPING PROGRAMS

Laurence J. McKee
Senior Software Engineer
General Dynamics/Electric Boat Division
Groton, Connecticut

Mr. McKee is currently responsible for development of interfaces to and from the Electric Boat Division piping design analysis and assembly programs to computervision. He has developed an interface between computervision and AUTOKON.

Mr. McKee holds a BS degree from Hofstra University Hempstead, New York.

Robert Sciullo
Manager Material
General Dynamics/Electric Boat Division
Groton, Connecticut

Mr. Sciullo's functions include computer system development and control and computer generation of pipe details which provided a logical conversion from batch to graphic terminals. Additional responsibilities are in the areas of material identification and sourcing; drawing control and issues; and contract definition and budgets. Data systems interface provides for involvement in virtually all aspects of engineering products and the interfaces with shipyard construction activities.

Mr. Sciullo attended Thames Valley State Technical College and Carnegie Institute of Technology.

ABSTRACT

The design and implementation of the computervision interface to the batch electric boat piping design analysis and assembly programs will be described. This interface will allow three-dimensional piping models produced on computervision to be processed by the Electric Boat Piping programs on the UNIVAC. The end result of this processing,would be assembly details which are delivered to the pipe shop for assembly.

Background

COMPUTERIZED PROGRAMS FOR PIPING SYSTEM EVOLUTION

1. Provided pipe bending data for length, bend angles, roll angles, and distance between bends.
2. Added fitting, valve, and hanger locations to both bent and straight pipe by match marking and creating pipe details.
3. Combined details into assemblies.
4. Generated isometric and orthographic drawings.
5. Added welding identification and data.
6. Extracted and added material information.
7. Expanded to include work authorizations, trade work instructions, feed relationships, test boundaries, and serialization.
8. Generated tapes for data transfer to work authorization files and reports for manufacturing and installation.

JUL 31, 1978 608-4644096 DET FWD TRIM SAN TK 1 & 2

DATE _____ BOAT NO. ___ S.O. _____

PIPEFITTER & BADGE NO. _____

SUPERVISOR _____

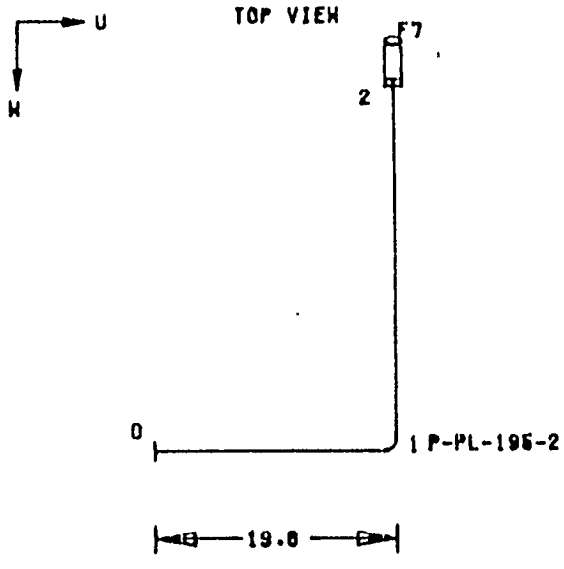
GENERAL DYNAMICS / ELECTRIC BOAT DIVISION

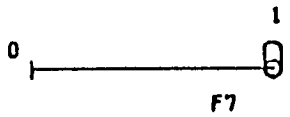
PLAN 87623-1307 PIPE P-PL-195-2 DET QR REV A APPLICABILITY WBR 2.5 FLOOR 38

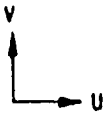
PT NO	DELTAS U	V	W
0-1	19.8	.0	.0
1-2	.0	.0	-30.1

LENGTH END TO END = 36.0 INCHES

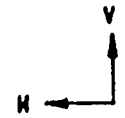
BEND	ROLL ANGLE	BEND ANGLE	DIST WIRE		PBR	DIST PIPE	STRAIGHT PIPE	CLAMPING OR FITUP	END JOINT
1	0	90	17.3	60	7.5	12.3	12.3	.0	38
	90		46.8			46.7	22.6	.0	38







SIDE VIEW



END VIEW

LIST OF MATERIALS

ITEM NO	SEQ	QTY	UM	MF	QTY	UM	NOUN	NAME	TYPE	MODIFIER	DOCUMENT OR	PART NO	ROUTING
NO		CLASS	LV	MF			SIZE			MATERIAL	DRAWING	SOURCE	REMARKS
P-PL-195	47		IN				TUBE				MIL-T-16420	46-65-0081	
0005	P-38		NA				1.90000 X 0.134MIN			CUNI	TY 1 OR 2 70-30		
F7		1	PC				ELBOW		45	SB	MIL-F-1183	15-00-4613	
2007			NA				1.500IPS 400PSI			BRZ	TY A		
F1		1	PC				SLEEVE		PEN		2621-601-09	262160109-0063	
2001			NA				1.500IPS 4.500LG			STL	PC 69	HAA-A7020005000	

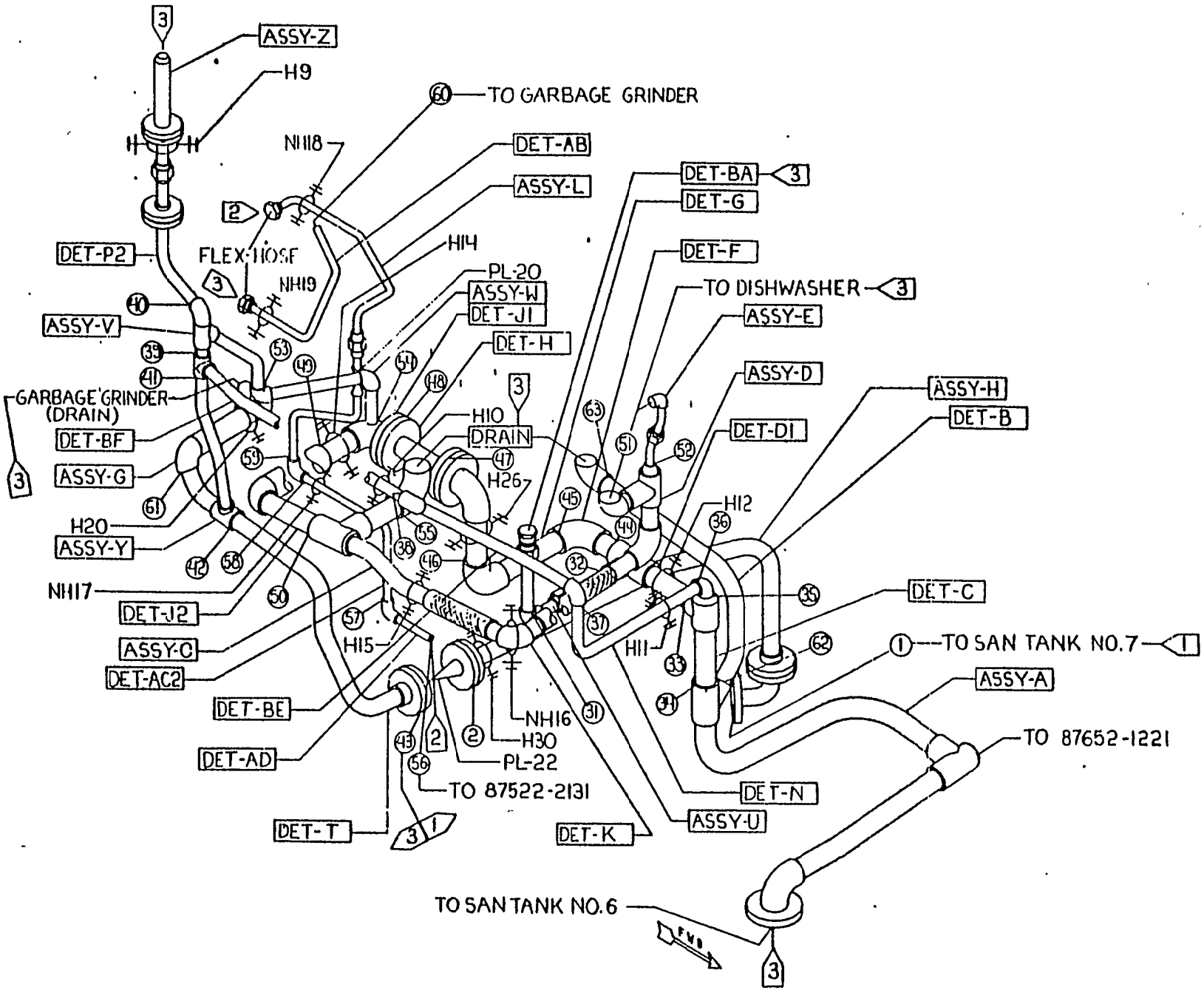
FABRICATION

ATTACH F7 AT POINT 2 AT JOINT IDENT. NO. 048-01-033

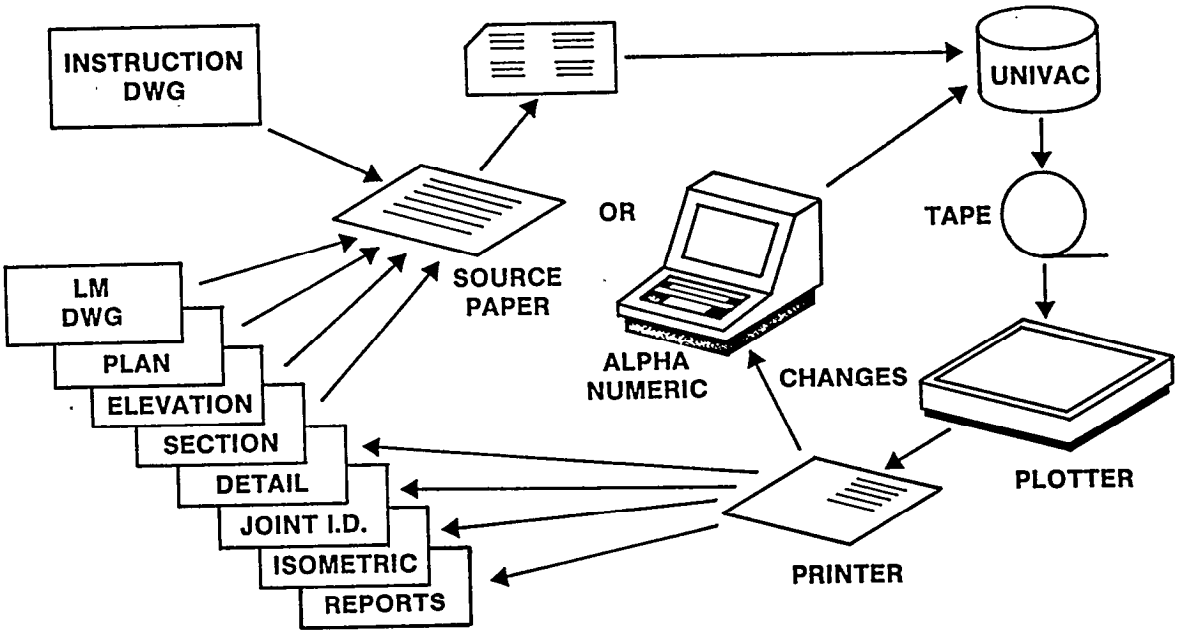
F7 (AT POINT 2) ATTACHED TO P-PL-195-1 OF DETAIL E AT JOINT IDENT. NO. 048-01-032

ATTACH F1 TO P-PL-195-2

NOTE: INCLUDES CONTROLLED AND NON-CONTROLLED JOINTS

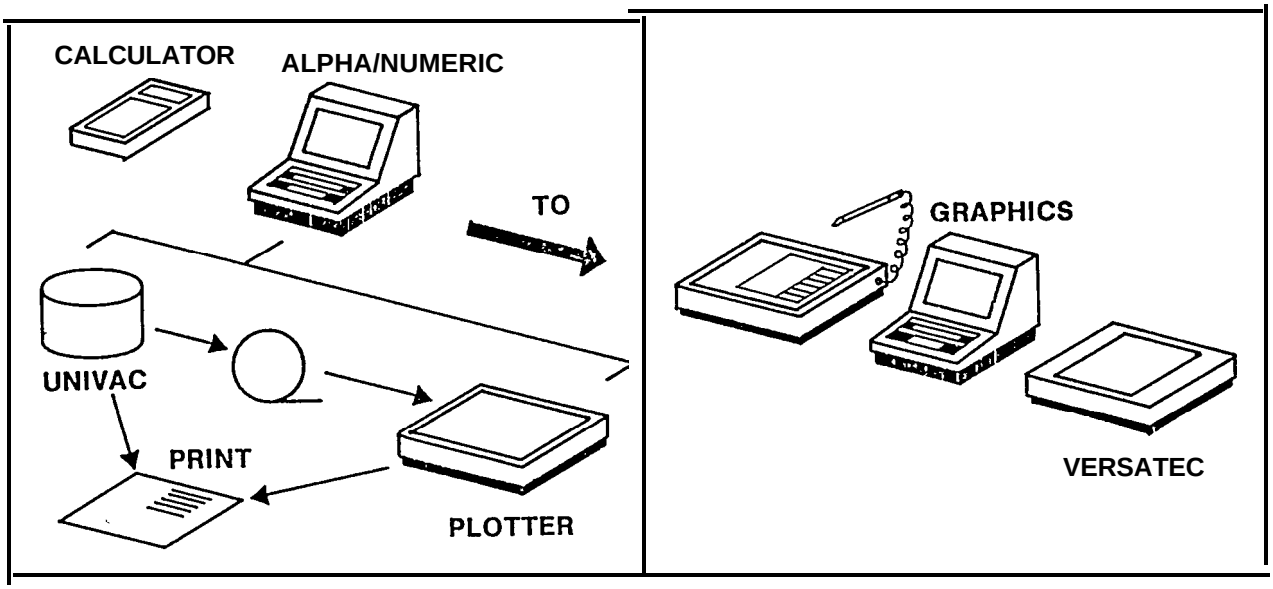

ASSY-Z
H9
TO GARBAGE GRINDER
NH18
DET-AB
ASSY-L
DET-BA
DET-G
DET-F
TO DISHWASHER
ASSY-E
ASSY-D
ASSY-H
DET-B
DET-DI
DET-C
TO SAN TANK NO.7
ASSY-A
TO 87652-1221
DET-N
ASSY-U
DET-K
TO SAN TANK NO.6
FWD
DET-P2
FLEX HOSE
NH19
H14
PL-20
ASSY-W
DET-J1
DET-H
ASSY-V
GARBAGE GRINDER (DRAIN)
DET-BF
ASSY-G
H10
DRAIN
H26
H12
H20
ASSY-Y
NH17
DET-J2
ASSY-C
DET-AC2
H15
H11
DET-BE
DET-AD
NH16
H30
PL-22
TO 87522-2131
DET-T

Background (Cont'd)

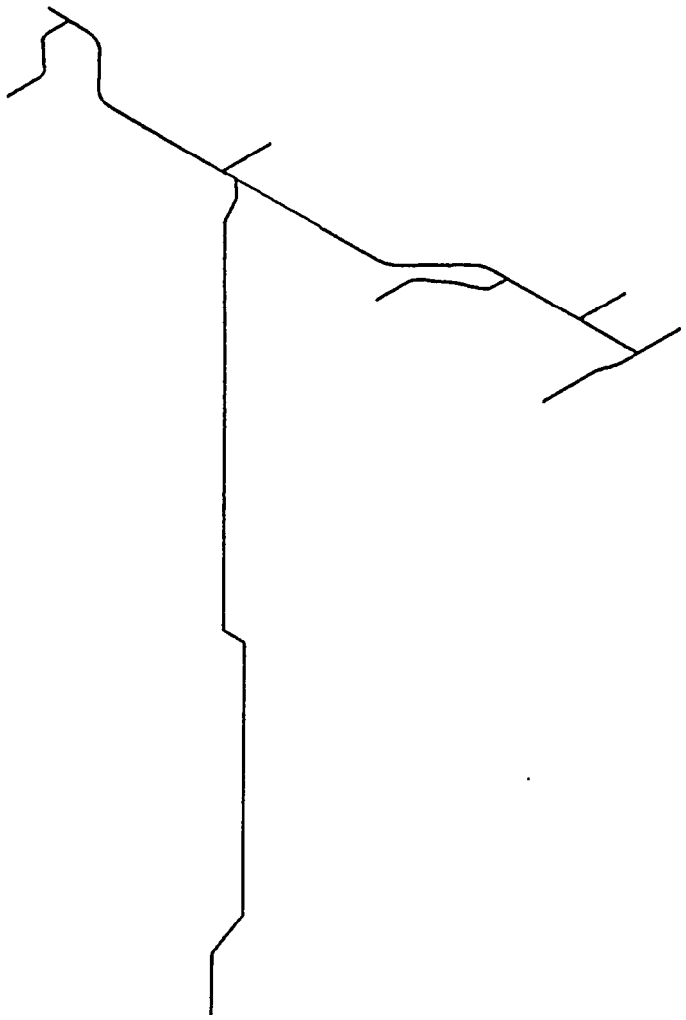


Transition

STATE OF THE ART ALLOWS A CHANGE IN SKILL LEVEL AND REDUCTION IN WALL TIME.



Isometric of Modeled Pipeline Routed with Bends



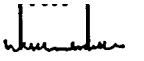
Approach

- **MUST BE TECHNICALLY EQUAL TO EXISTING PRODUCTS.**
- **MUST BE COST-EFFECTIVE WITH REAL BENEFITS (MANHOURS AND WALL TIME).**

- **ESTABLISH PLAN AND MILESTONES**

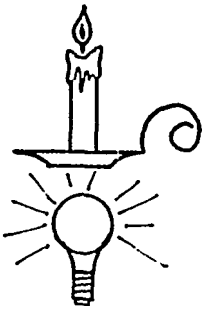
1. **Training on CADDS 3**
2. **Execution on CADDS 3**

3. **Mods/workarounds CADDS 3**

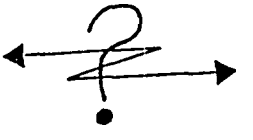


CADDS 3

4. **Training on CADDS 4**

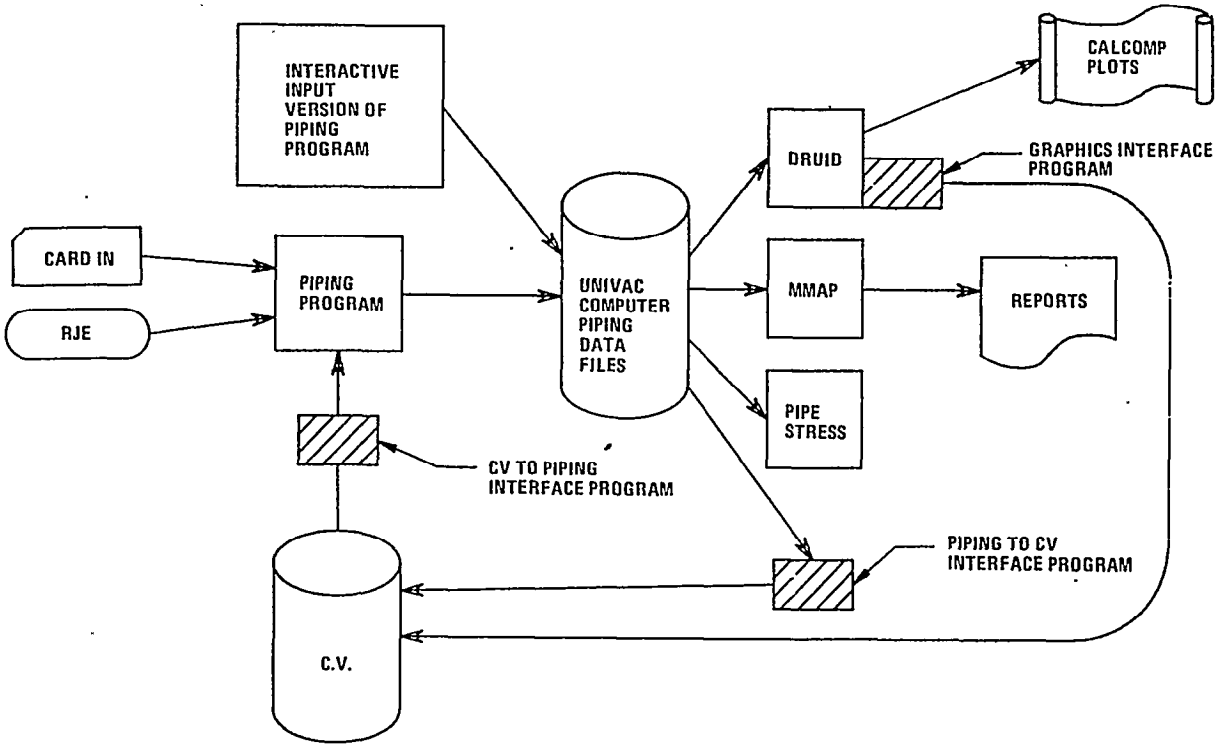


5. **Execution on CADDS 4**
6. **Mods/workarounds CADDS 4**
7. **CADDS 4 → IN / UNIVAC → OUT**



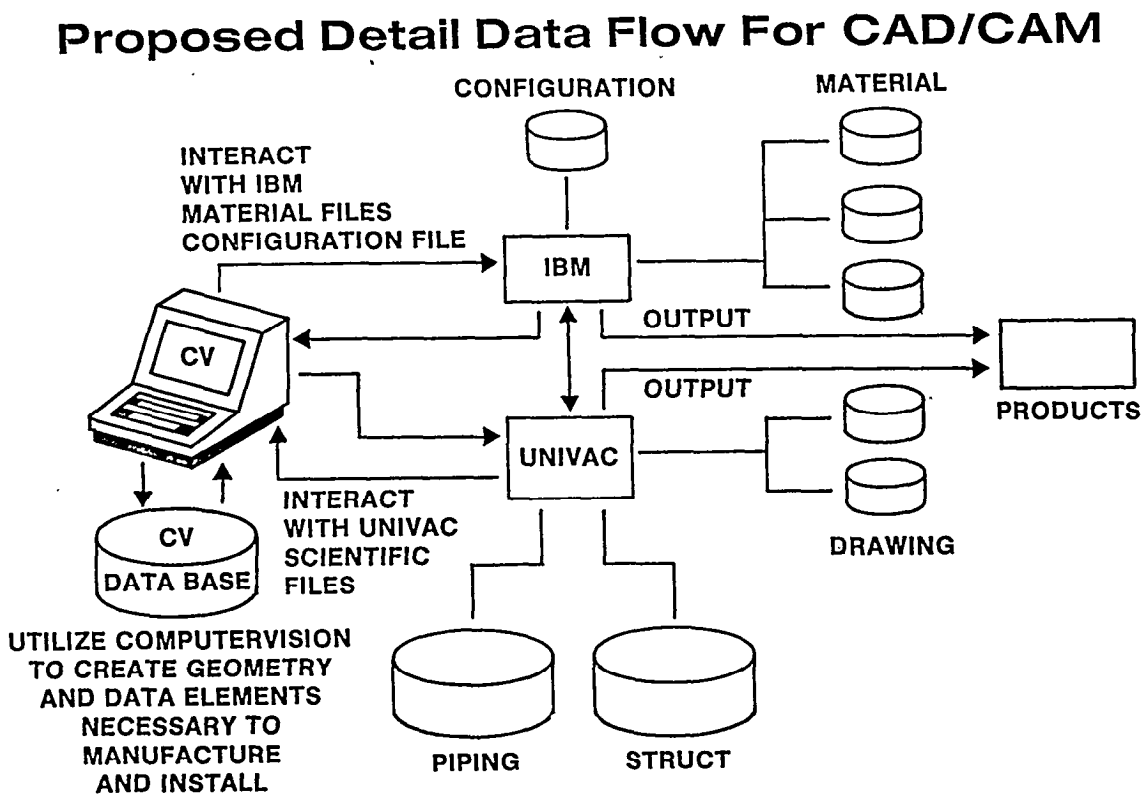
8. **Committee programming/data flow**

Computervision/Univac System Flow Chart



Approach (Cont'd)

- PROGRAMMING - IN-HOUSE OR CV? ~~CV~~
- DATA FLOW
  1. CV → IBM → UNIVAC — INTELLIGENCE
  2. UNIVAC → CV — DUMB
  3. UNIVAC → IBM → CV — INTELLIGENCE
- TEST AND ACCEPTANCE
  1. Equal products
  2. Time trial - Machine ~~6~~ vs 5
  3. Time trial - Human



Creating A Pipe Detail With Bend and Match Mark Data

COMPARISON OF BATCH TO COMPUTERVISION

Step 1

BATCH (8 hrs, 1 day)

Obtain Cartesian coordinates from mockup, layout, shipcheck, etc.

COMPUTERVISION (8 hrs, 1 day)

Obtain Cartesian coordinates from mockup, layout, shipcheck, etc.

S t e p 2

BATCH (20 hrs, 2-1/2 days)

Fill out source paper for key punch.

COMPUTERVISION (12 hrs, l-1/2 days)

Model piping system.

Step 3

BATCH (3 hrs, l-1/2 days)

Run PIPER program until error-free. Run DRUID program for isometric or orthographic plots.

COMPUTERVISION (2 hrs, 1 day)

CV data base interfaced to DRUID for isometric or orthographic plots.

Step 4

BATCH (2 hrs, 1 day)

MMAP Interface program - pipe details

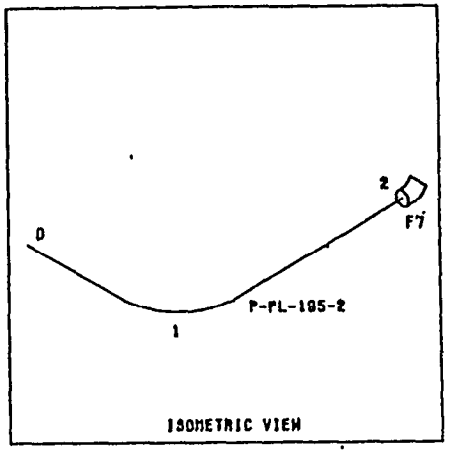
COMPUTERVISION (2 hrs, 1 day)

MMAP Interface program - pipe details

Totals

BATCH - 36 hrs, 7 days

COMPUTERVISION - 24 hrs, 4-l/2 days



AUG 25, 1982 S08-4644095 DET FWD TRIM BAN TK 1 & 2

DATE _____ BOAT NO. ___ S.O. _____

PIPEFITTER & BADGE NO. _____

SUPERVISOR _____

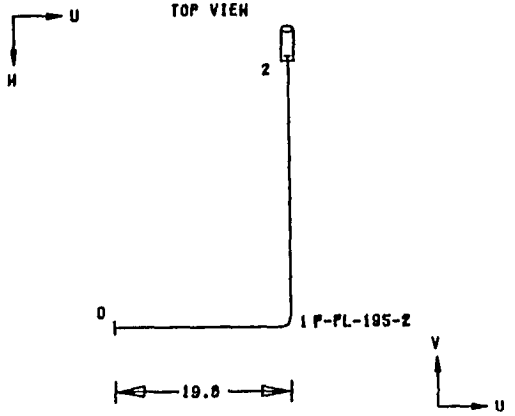
GENERAL DYNAMICS / ELECTRIC BOAT DIVISION

PLAN	PIPE	DET	REV	APPLICABILITY	SHEET
87529-1307	P-PL-195-2	AA	K	ABCDEF	27
		WBR	2.5	FLOOR 36	

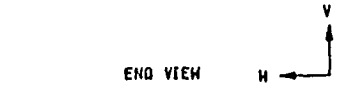
PT NO	DELTAS U	V	W
0-1	19.8	.0	.0
1-2	.0	.0	-30.1

LENGTH END TO END = 36.0 INCHES

BEND	ROLL ANGLE	BEND ANGLE	DIST WIRE		DIST PIPE	STRAIGHT PIPE	CLAMPING OR FITUP	END JOINT
1	0	90	17.3	SO 7.5	12.3	12.3	.0	68
	90		46.8		46.7	22.6	.0	88



SIDE VIEW



END VIEW

LIST OF MATERIALS

ITEM NO	SEQ	QTY	CLASS	UM	NOUN NAME	TYPE	MODIFIER	MATERIAL	DOCUMENT OR DRAWING		PART NO TON-N REQ
P-PL-195		47		IN	TUBE				MIL-T-16420	CL 1650	48-85-0061
	0005	P-3R		NA	1.9000D X 0.134MIN			CUNI	TY 1 OR 2 70-30		
F7		1		PC	ELBOW	45		SB	MIL-F-1183		15-00-4513
	2007			NA	1.500IPS 400PSI			BRZ	FIG 7 TY A		
F1		1		PC	SLEEVE	PEN			2621-601-09	ASTM-A441	262160109-0053
	2001			NA	1.500IPS 4.500LG			SIL	PC 53		

FABRICATION

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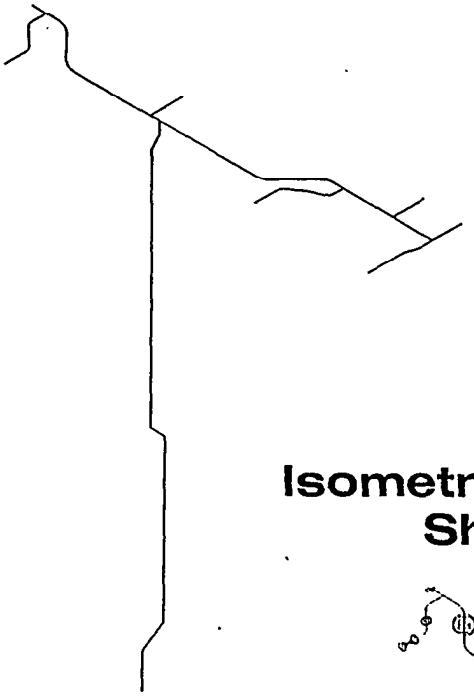
F7 (AT POINT 2) ATTACHED TO P-PL-195-1 OF DETAIL 2 AT JOINT IDENT. NO. 048-01-032

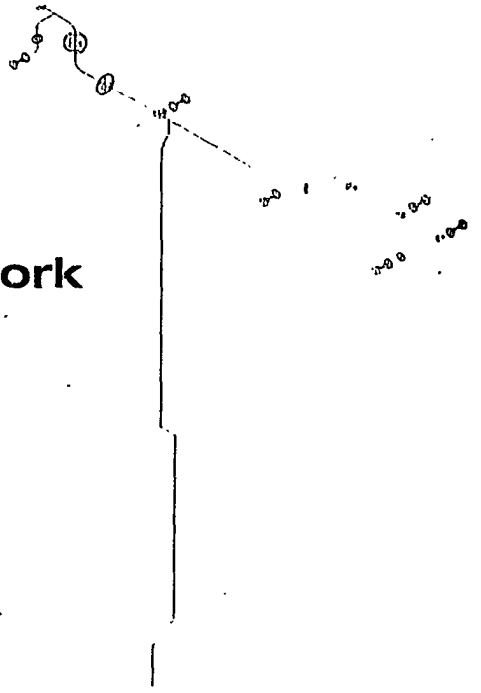
ATTACH F1 TO P-PL-195-2

PAINT WITH EPOXY COATING SYSTEM

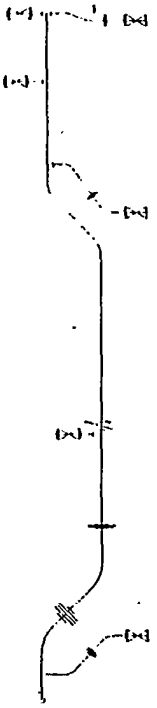
Isometric of Modeled Pipeline Routed with Bends



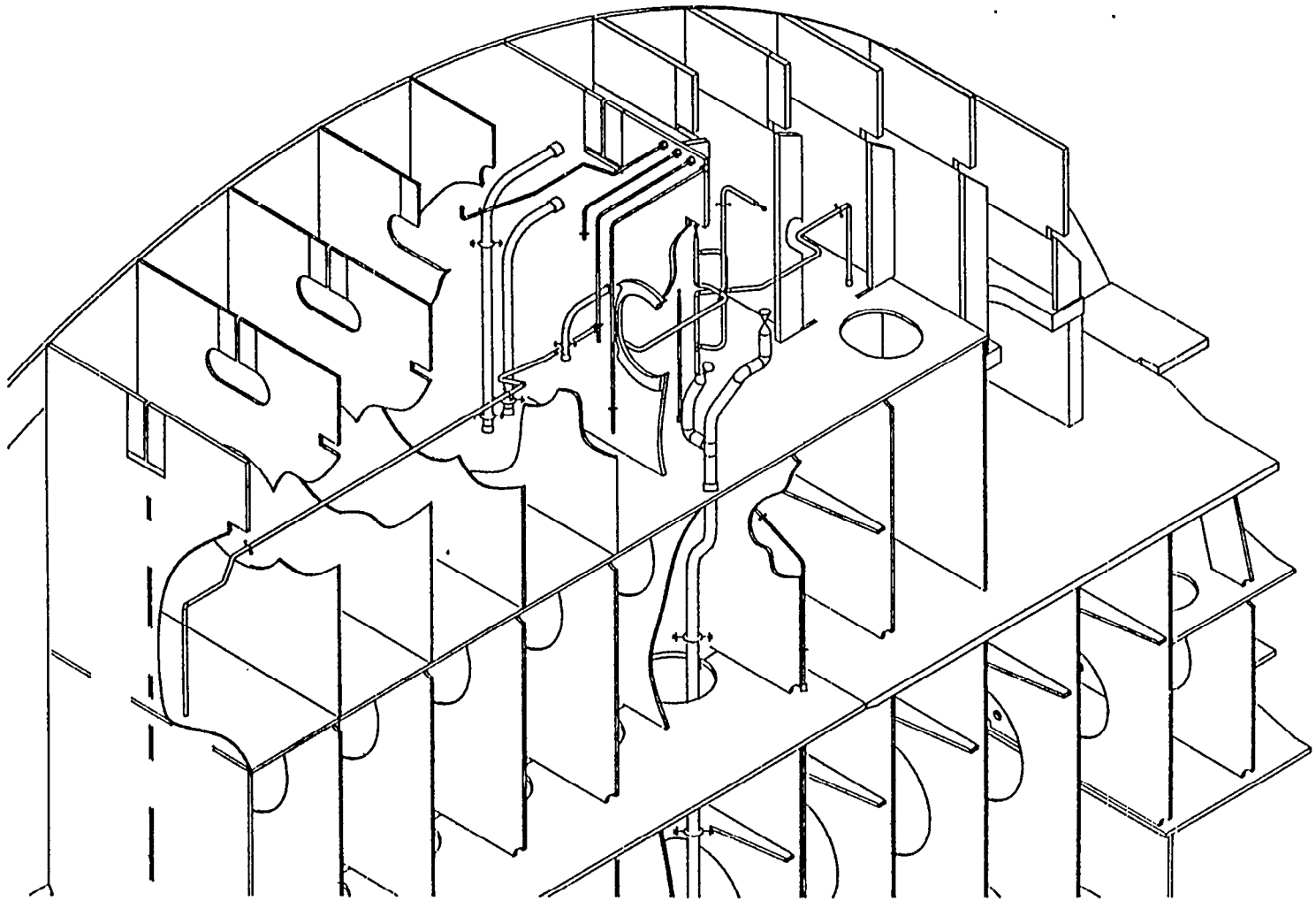
Isometric of Piping Network Showing Fittings



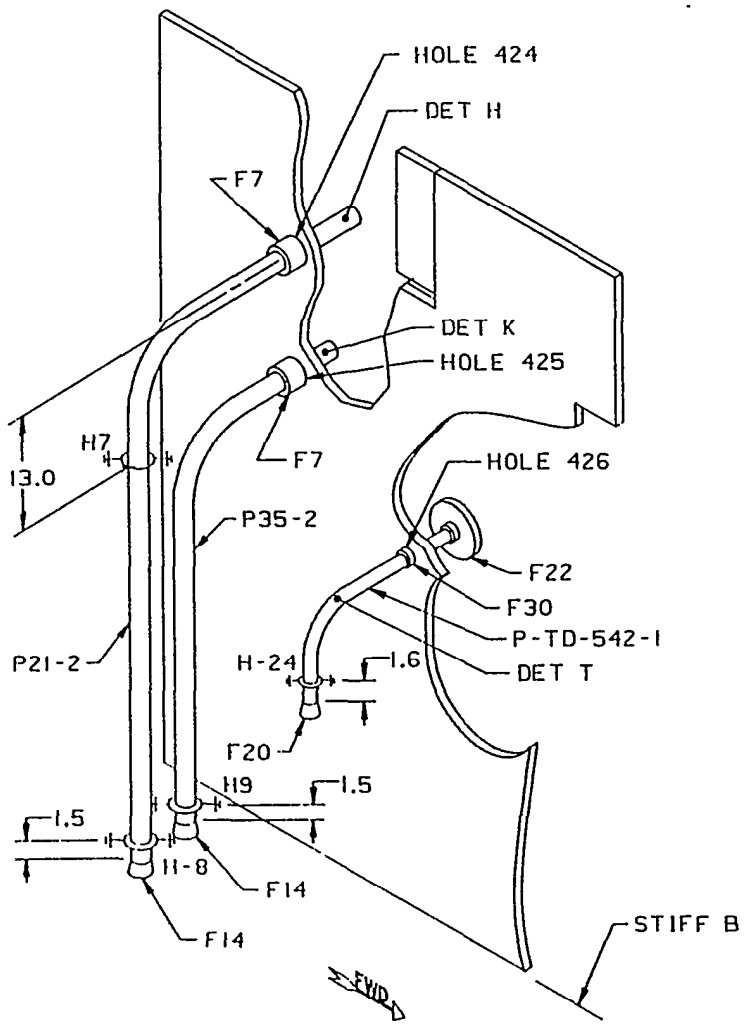
Plan View of Piping Network



Cutaway Isometric Showing Combination of Piping and Structural Systems



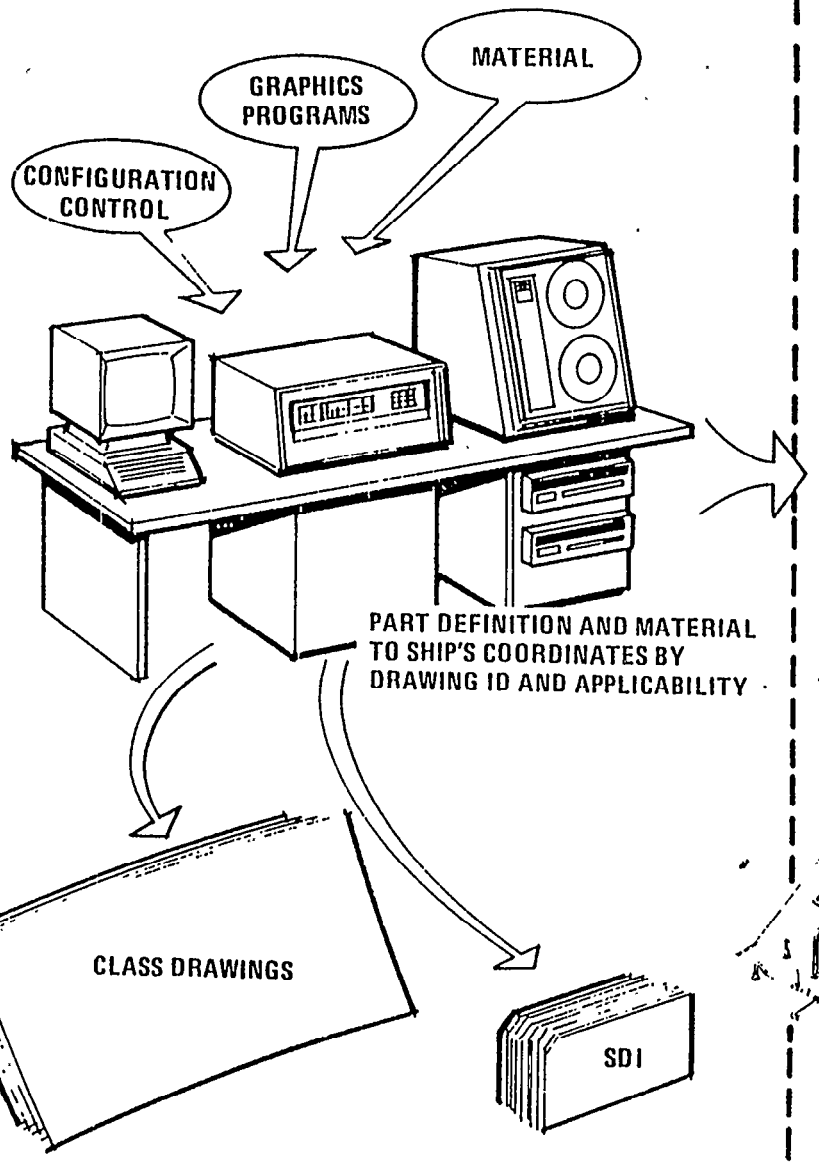
Labeled Isometric Showiing Pipe Penetrating Structure



Results

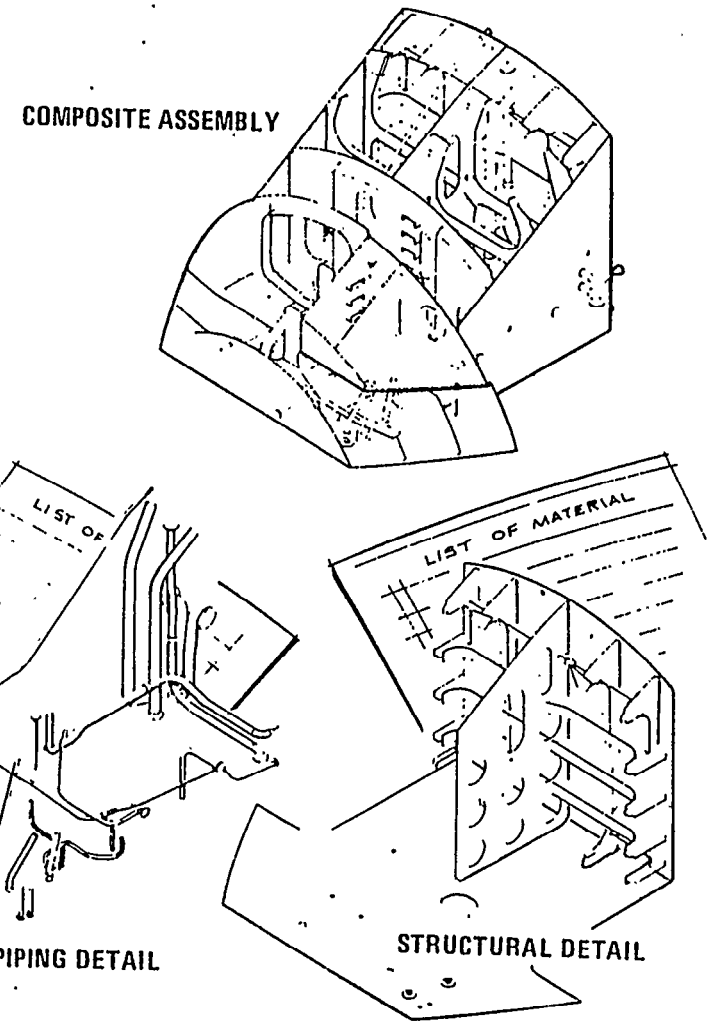
- PROMISING
- CAN GENERATE PRODUCTS
- MARRY EXISTING TECHNOLOGY WITH NEW TECHNOLOGY
- MODS/WORKAROUNDS ARE ESSENTIAL
- USERS AND PROGRAMMERS MUST WORK AS A TEAM
- SIDE BENEFITS

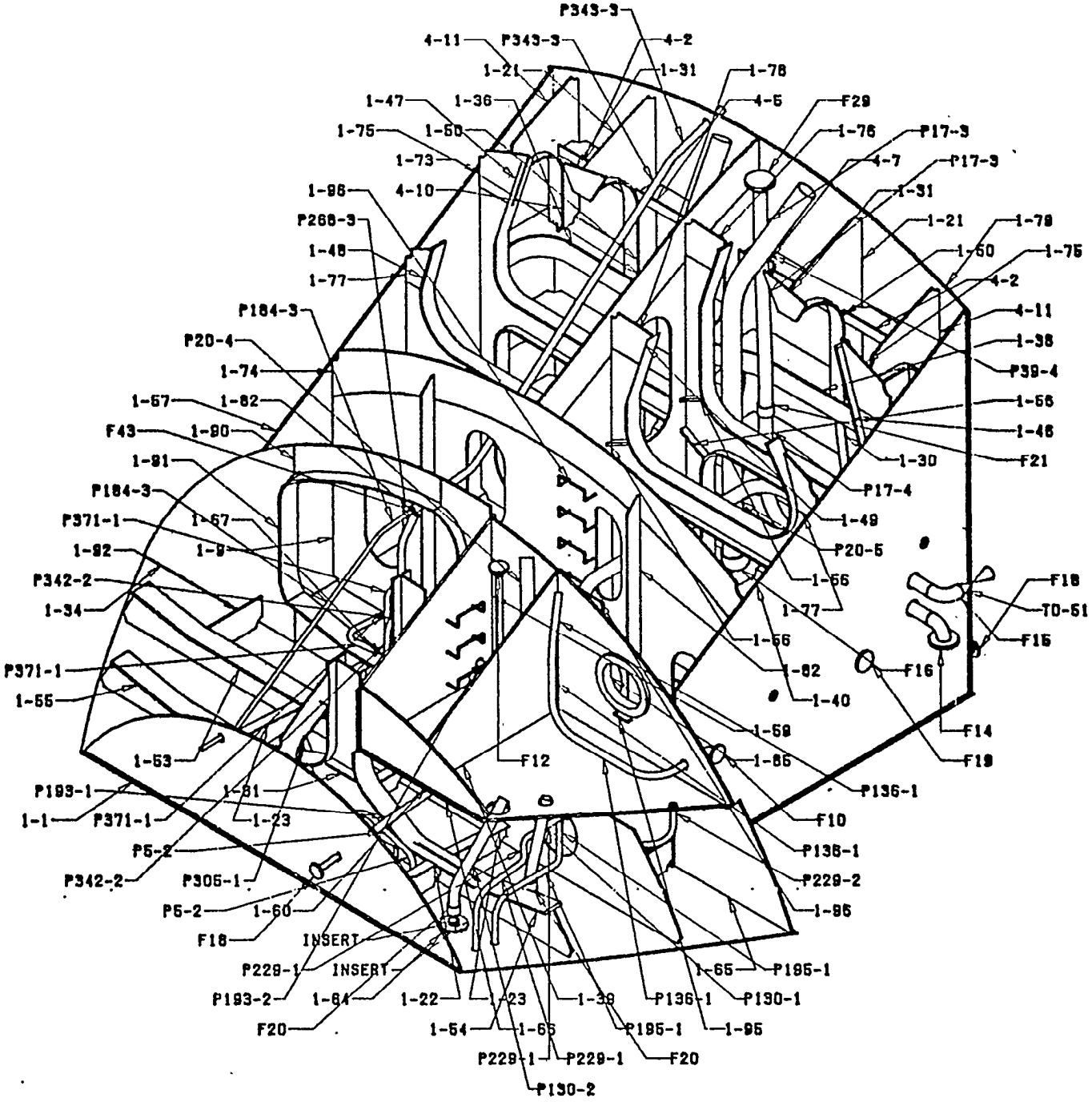
Capture & Control Data



Package Work

IN ACCORDANCE WITH SHIPYARD WORK AUTHORIZATIONS AND SCHEDULES





ISOMETRIC

1/32 SCALE 3/8 IN/FT